

JPL



AIRS and GPS Occultation: Validation at the Tropopause and Pressure Retrieval



Stephen Leroy (JPL)
May 2, 2002



*AIRS Science Team Meeting, May 2,
2002*

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AIRS and GPS Occultation (Leroy)

Outline



- What are occultations? Characteristics and examples.
- How can they be useful for AIRS? Validation in certain limits.
- Data availability. <http://genesis.jpl.nasa.gov>.

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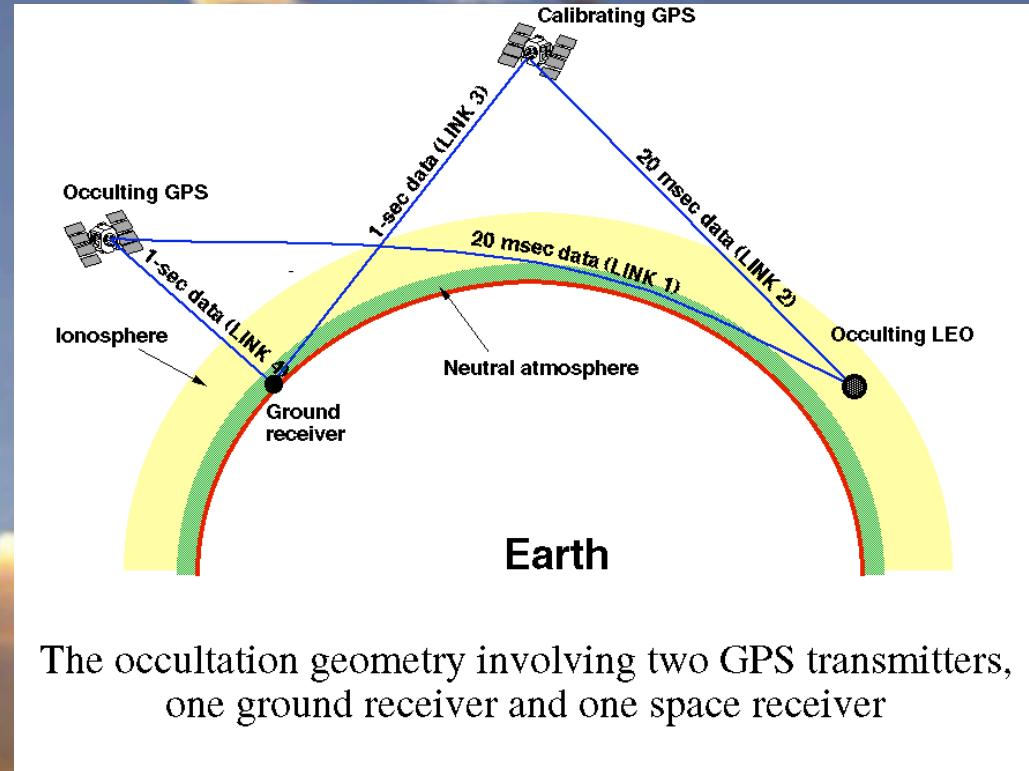
GPS Occultation Technique

- Active microwave limb sounding
- Two frequencies (1.2 and 1.6 GHz) to eliminate ionosphere
- Vertical resolution ~100 m, horizontal resolution ~300 km
- Insensitive to usual calibration errors [] clocks eliminated by “double-differencing”



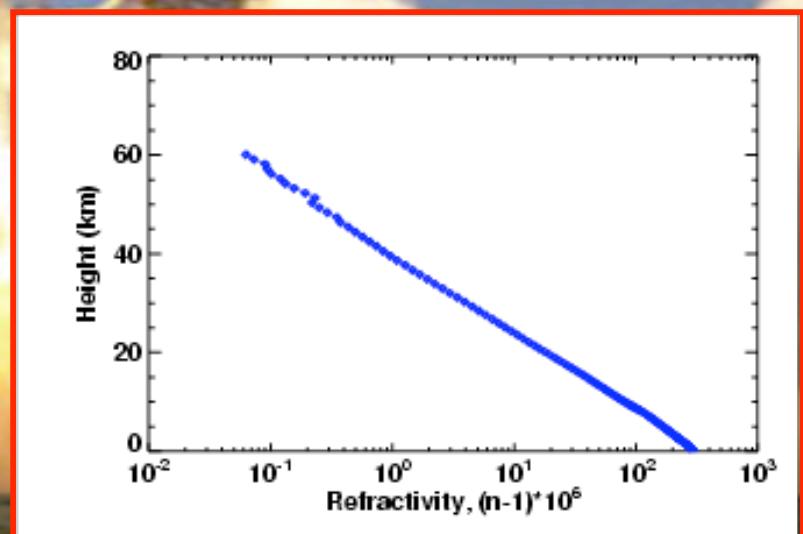
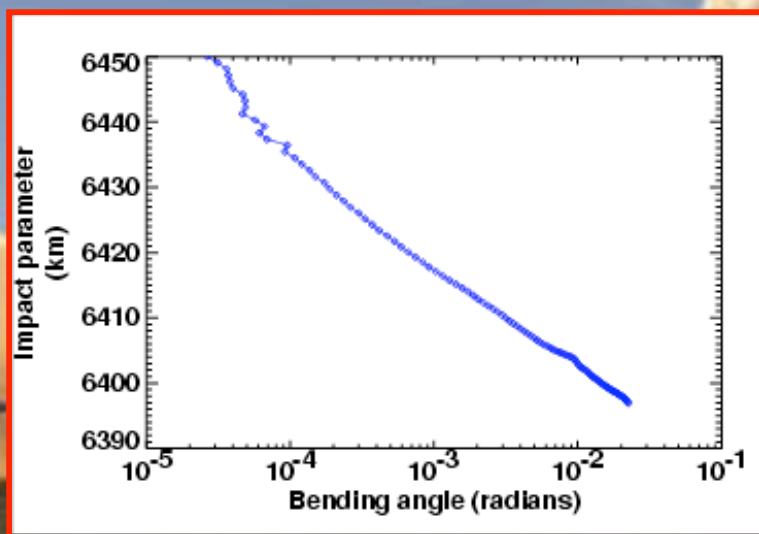
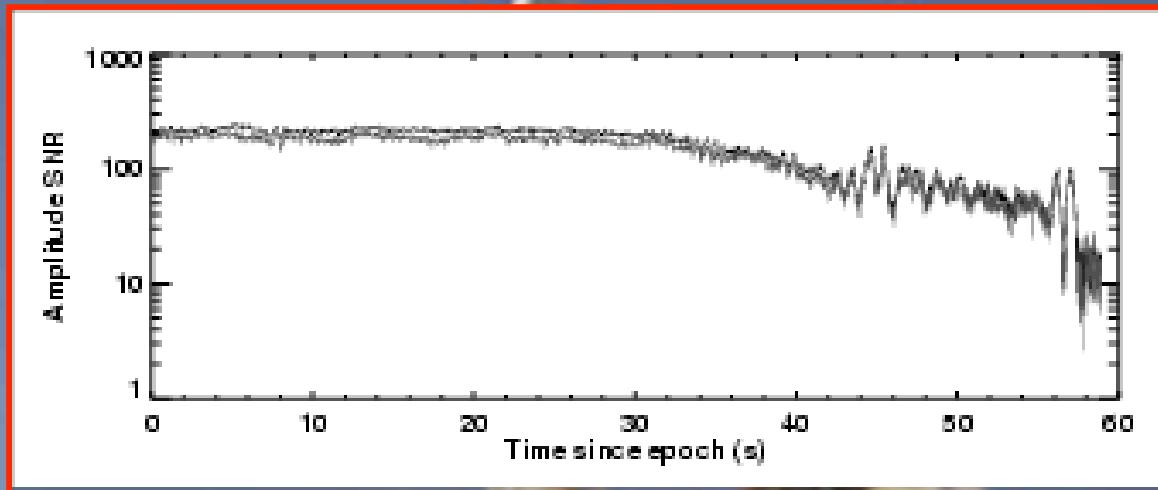
GPS Occultation Technique (cont'd)

- ~250 soundings per day per receiver
- Soundings are globally random but roughly follow orbit track
- GPS/MET (1995-7) was proof-of-concept
- Profiles refractivity:
 $N=77.6 \frac{p}{T} + 3.73e5 \frac{p_w}{T^2}$



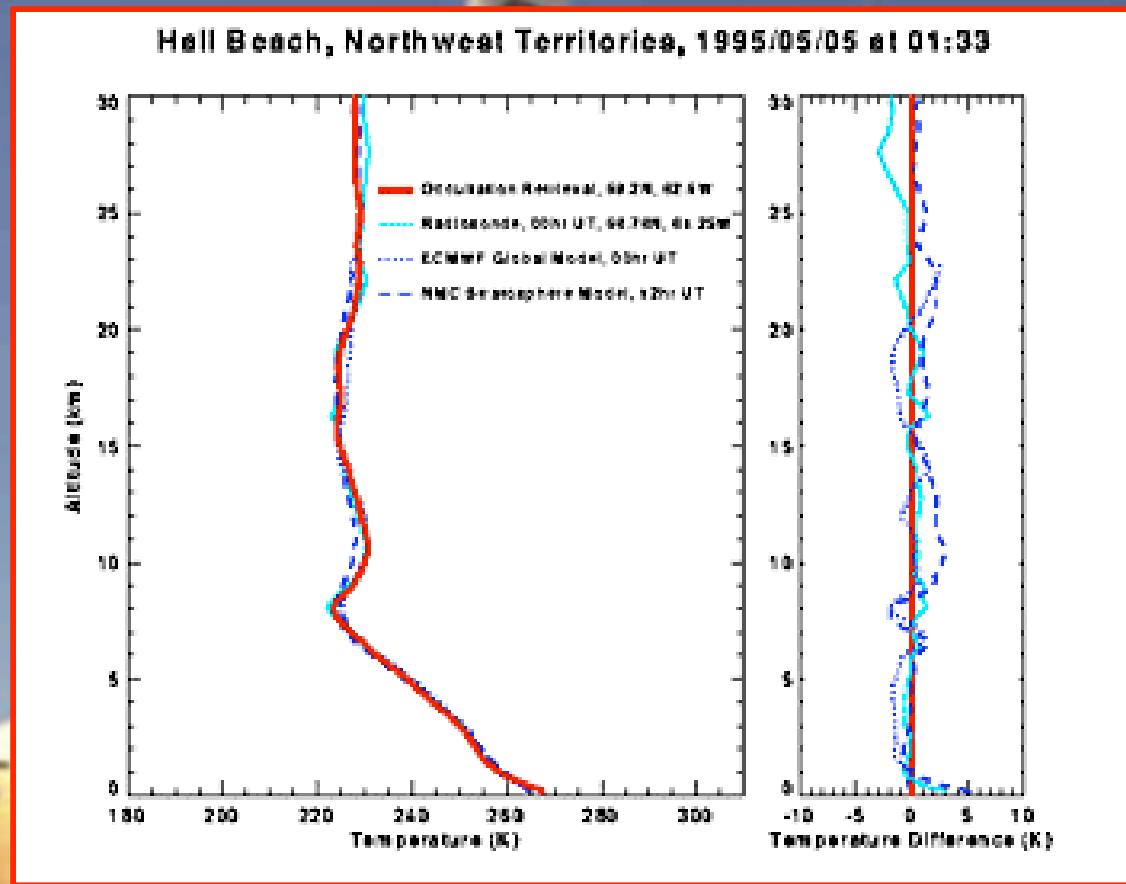


An example occultation

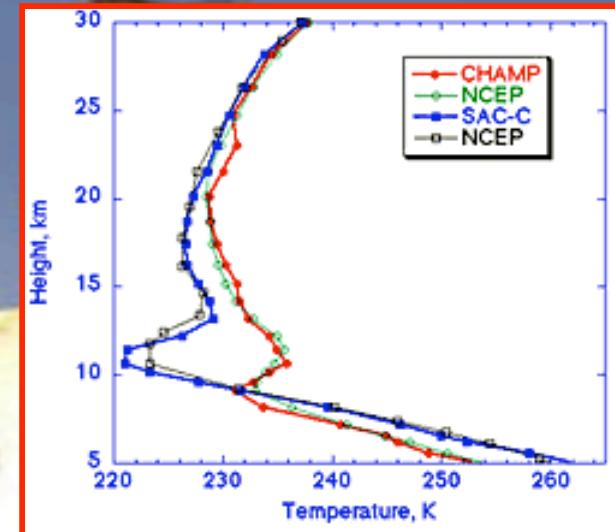
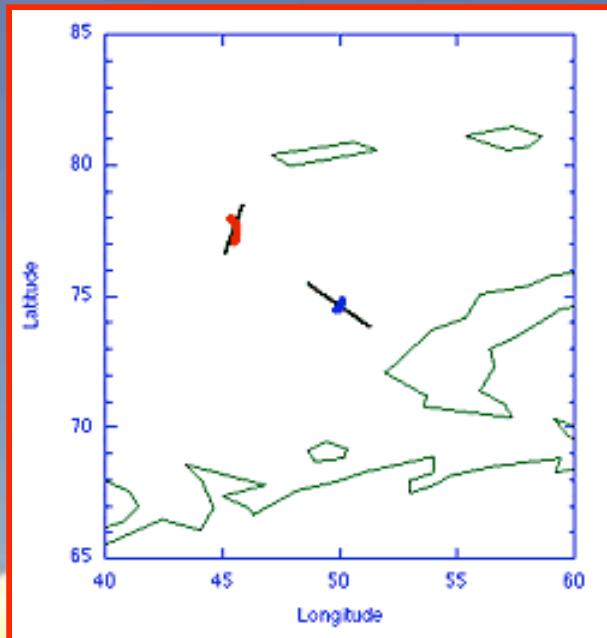




An example occultation (cont'd)



Horizontal resolution issues



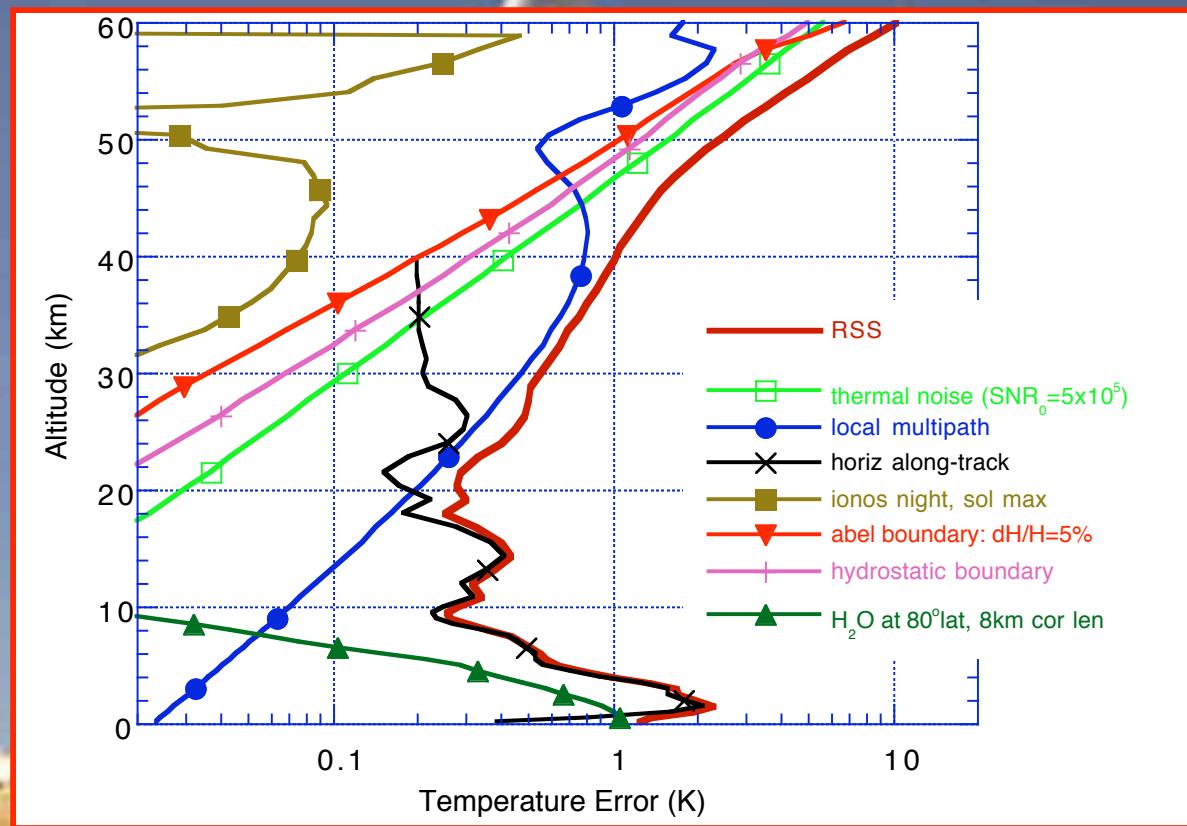
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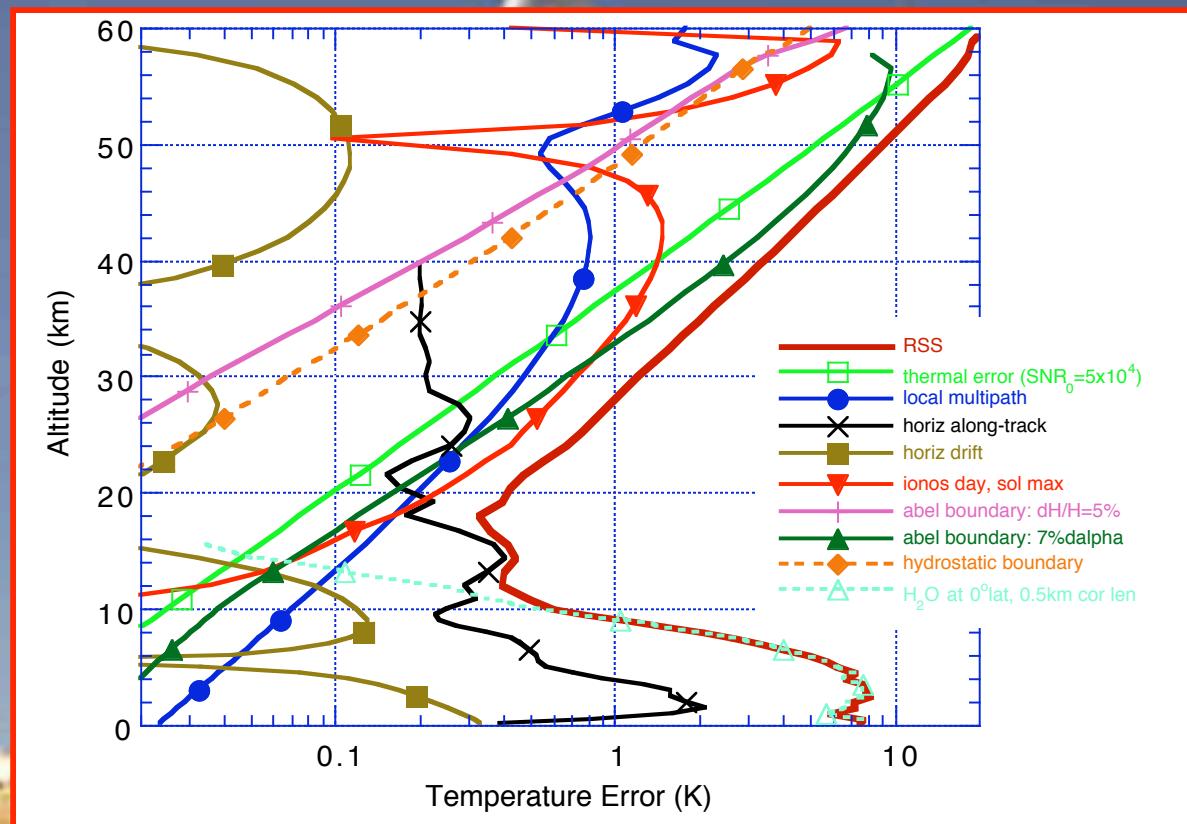


Predicted accuracy, polar lat's

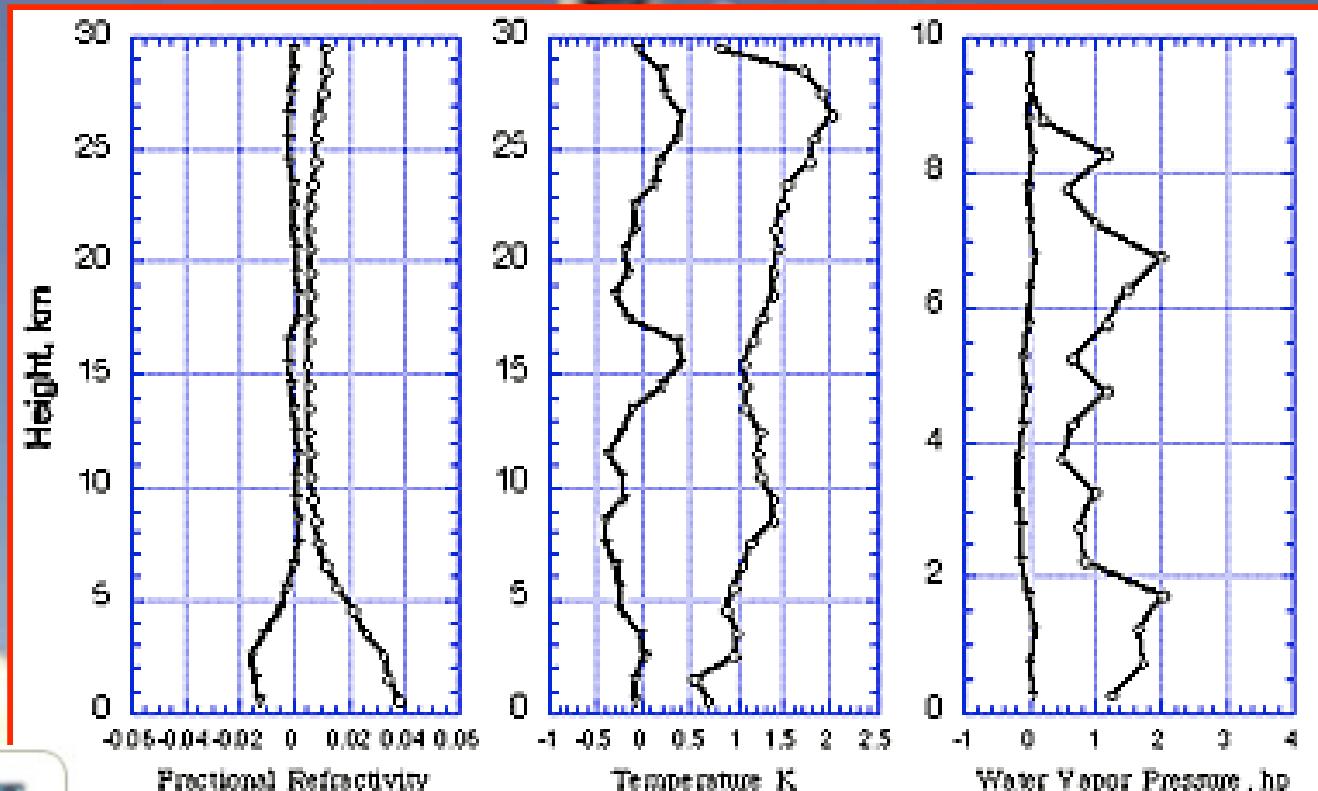


From Kursinski et al. (2000)

Predicted accuracy, equatorial lat's



Comparison to ECMWF profiles

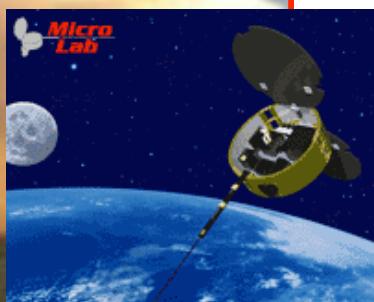
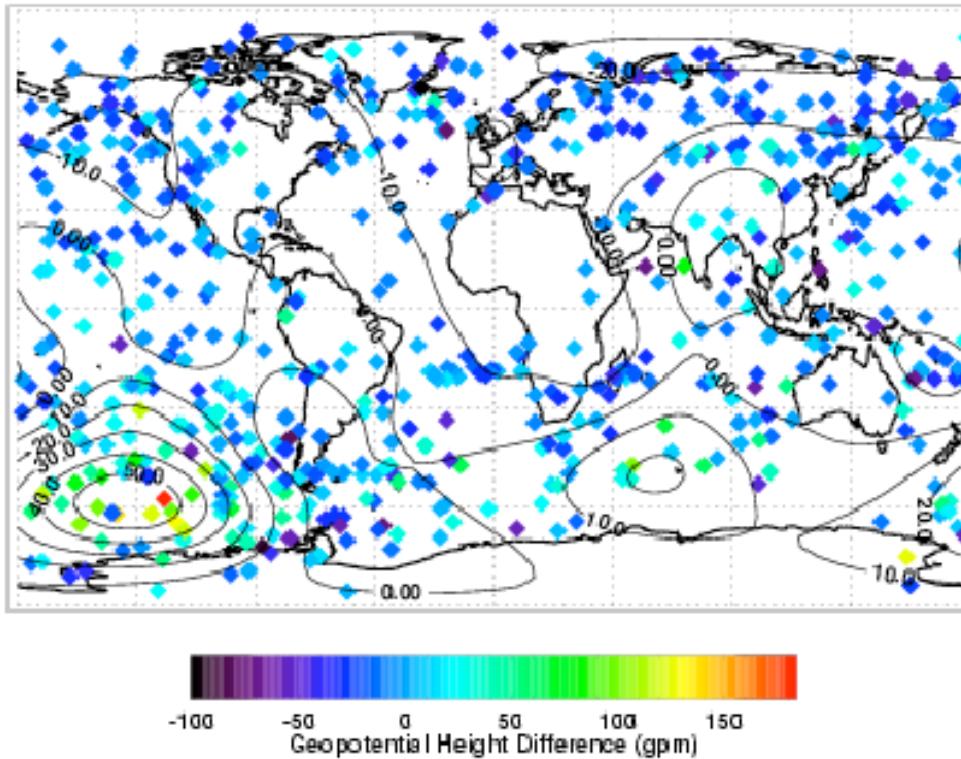


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Comparison to ECMWF analysis

Height Difference at 300mb: Occultations - ECMWF, Summer

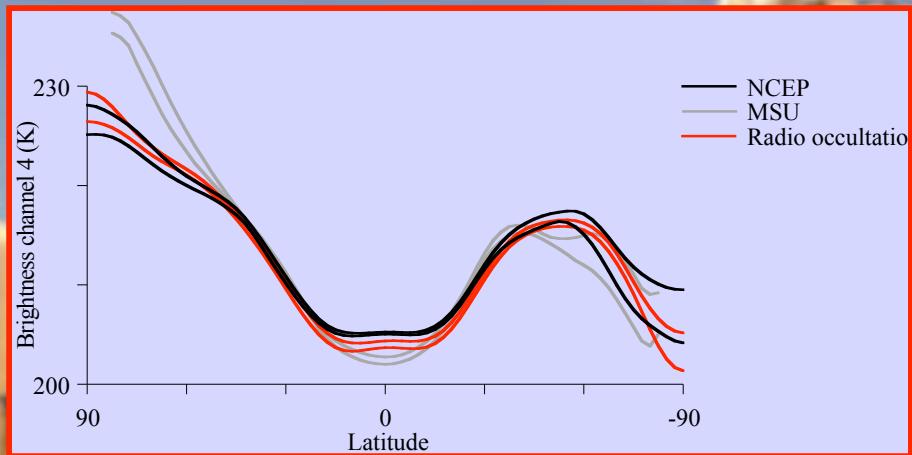
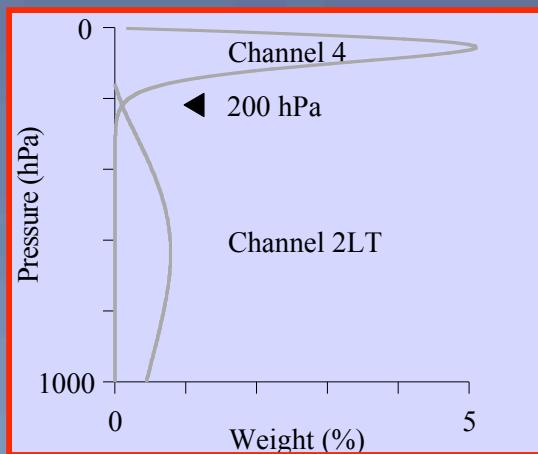


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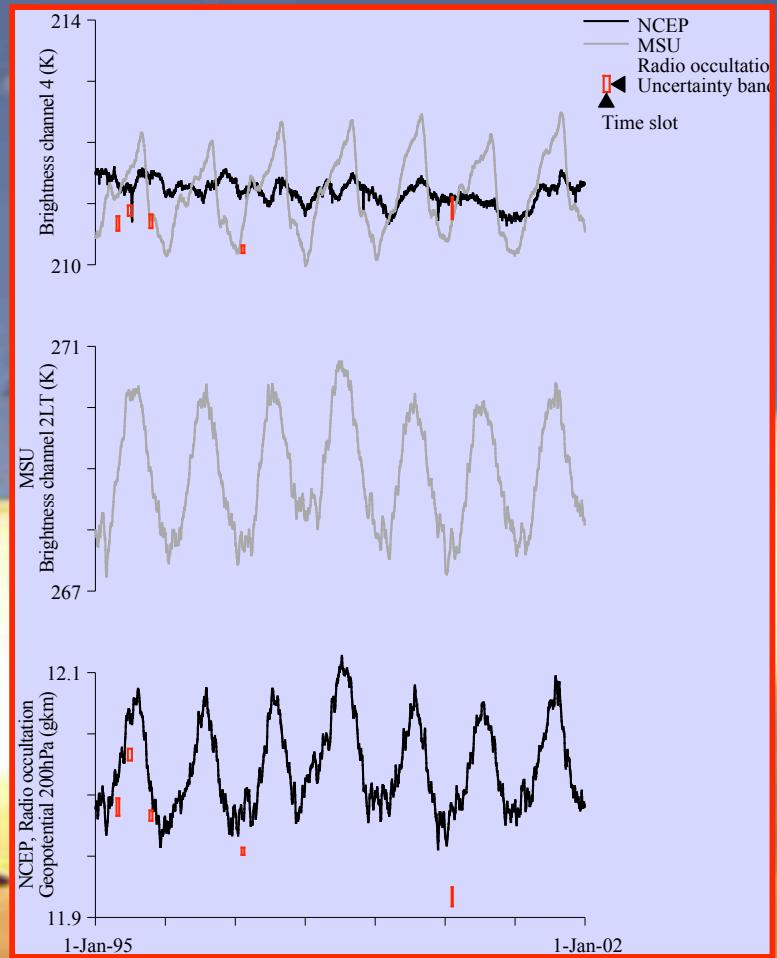
From Leroy (1997)



Validation of MSU timeseries



Northern spring, 1995.



From Schröder et al. (2002)

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Current and planned missions



CHAMP

Geophysikalisches Forschungszentrum
(Potsdam), JPL

Launched July 15, 2000

$i=87^\circ$, $z=454\text{km}$, $T=93.55\text{mins}$, $T_n=966\text{ days}$

Collecting occ'ns since April 6, 2001

genesis.jpl.nasa.gov

SAC-C

Comisión Nacional de Actividades
Espaciales (Buenos Aires), JPL

Launched January 25, 2001

$i=98.2^\circ$, $z=702\text{km}$, $T=98.8\text{mins}$, 10:15LT

Collecting occ'ns since July 7, 2001

genesis.jpl.nasa.gov

GRACE

University of Texas, JPL, DLR

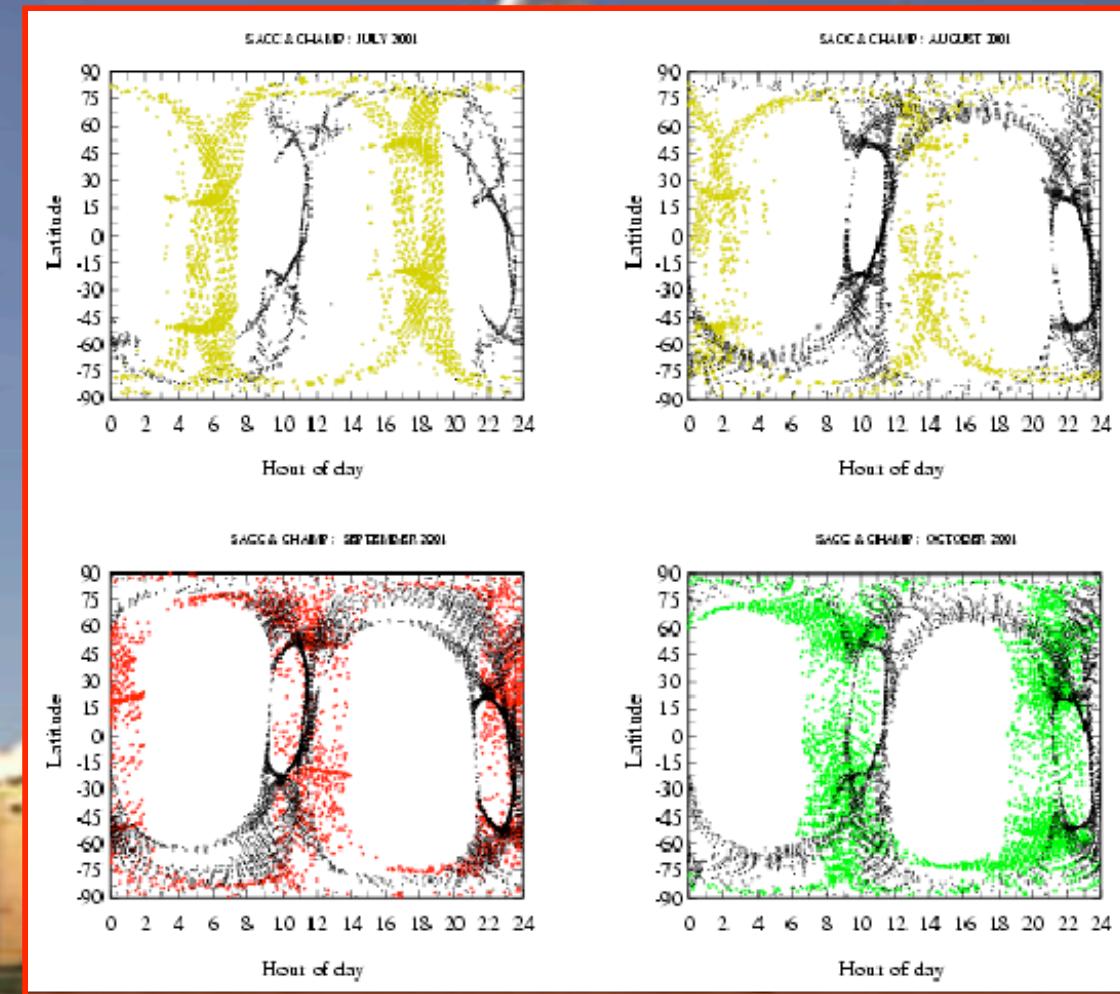
Launched March 17, 2002

Two spacecraft, $i=89-90^\circ$, $z=300-500\text{km}$

Begin occ'n profiling July, 2002, 250-500
occ'ns/day

genesis.jpl.nasa.gov

Local time coverage





Possible plan for AIRS validation

- Regular co-locations at polar latitudes
- Episodic co-locations globally (SAC-C, GRACE)
- Asynchronous validation – probably require many footprints to cover horizontal extent of occultation!
- <http://genesis.jpl.nasa.gov> - provides occultation data in HDF-EOS



Retrieve pressure

- GPS's absolute position information, when convolved with a gravity model, provides heights of constant pressure surfaces.
- As research, one can combine 3D AIRS data with occultation data to retrieve height information for all AIRS footprints.